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AN EFFECTIVE PORTABLE SPRAY IRRIGATION LAYOUT

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With a new type of portable spray irrigation equipment now being developed by the U.S. Bureau of Agricultural Engineering, it is possible to provide equipment for spray irrigation at a cost of $250 per acre, using new equipment. If second-hand equipment in good condition is obtainable the cost will be even less. W.C. Kruger of the New Jersey Agricultural Extension force first suggested the idea of using discarded wagon or buggy wheels for the supports for portable overhead spray nozzle pipes. So far this type of equipment has only been used experimentally and its limitations are not clearly defined but it seems to offer considerable promise for the irrigation of suitable small tracts devoted to the production of low growing crops. This system is not at present recommended for large installations.

This system consists of sprinkler pipes supported on wooden wagon or buggy wheels, spaced 15 to 18 feet apart, so that the whole nozzle-line assembly can readily be rolled from place to place. Two men or boys can easily move 100 feet of pipe, or three can move 180 feet. To use the wheels it is necessary to enlarge the holes through the hubs so that the pipe can pass through. This may readily be done by heating red hot one end of a 4-foot piece of pipe of the same size as the spray nozzle pipe, and forcing it through the wooden hub. In contact with the wood, the pipe will char its way through and leave a smooth hole of suitable size. If old wagon or buggy wheels are used, which would be very suitable for the purpose, it will be necessary to knock out the iron boxes before trying to enlarge the hole through the hub.

Pipe larger than usual for this kind of irrigation must be used for carrying the nozzles, not because of a limited water capacity, but because small pipes are too flexible for satisfactory rolling from place to place. One-and-a-quarter-inch pipe is the smallest that will be practical for this purpose, and it should be galvanized. As an example to show the materials and requirements for irrigating a tract by this system, a bill of materials, based on prices quoted late in 1934 by one of the large mail order houses, is presented below. A few items are included that are not carried by the mail order house, but the prices given in such cases are believed to be those at which the article may be obtained from reputable concerns. From

this it is assumed that the prices apply on a nation-wide basis and that the material for this type of irrigation can be obtained for about this cost in any locality, only the freight charges varying from region to region.

For the example, it is assumed that water will be pumped from a lake or natural stream by a gasoline-engine-driven pump, that 100 feet of pipe will take it to the edge of the irrigated tract; and that an additional 425 feet will carry it through the field. Along this pipe, at 50-foot intervals, suitable outlets are provided to connect with the portable spray lines when rolled to the proper positions. The plot to be irrigated is here considered as 450 feet long and 200 feet wide. On each side of the long main pipe, a 100-foot length of 1-1/4 inch galvanized pipe with common spray irrigation nozzles placed at 3-foot intervals is used. Six wheels placed 18 feet apart are used to support each line, the outer wheels being 5 feet from the ends. As it is not always possible to roll the spraying pipe to the exact location desired, a hose connection is used to connect it to the outlet on the main. The complete bill of materials, with the cost exclusive of freight, is as follows:

Nozzle Line

1 - 1-1/4-inch galvanized plug	$0.06
100 ft. 1-1/4-inch pipe, galvanized	13.50
33 nozzles, irrigation at 5 cents	1.65
6 - wheels, wagon, 44-inch diameter	34.80
1 - 1-1/4-inch turning union, Irrig.	3.50
1 - 1-1/4-inch elbow, 90° galv.	.19
1 pc. 1-1/4-inch pipe 18-inches long, galv.	.35
1 - 1-1/4-inch elbow 90°, galv.	.19
1 - 1-1/4-inch nipple, 2-1/2 inches long, galv.	.07
1 - 1-1/4-inch union, galv.	.44
1 - 1-1/4-inch nipple, 6 inches long, galv.	.12
10 ft. - 1-1/2-inch flexible water hose	2.50
1 - 1-1/4-inch nipple, 6 inches long, galv.	.12
1 - 1-1/4-inch union galv.	.44
1 pc. 1/2-inch pipe 18 inches long, galv.	.19
1 pc. 1-inch pipe 16 inches long, galv. (Threaded one end only)	.21
1 - 1-inch coupling, galv.	.12
1 - 1-inch by 3/4-inch bushing, galv.	.08
Total for 1 nozzle line	$58.53

Two of these required - cost of two $117.06

Risers for outlets

1 pc. 1-1/4-inch pipe, 2 feet long, galv.	$ .26	
1 - 1-1/4-inch elbow, galv.	.19	
1 - 1-1/4-inch nipple, 2-1/2-inches long, galv.	.07	
1 - 1-1/4-inch gate valve, brass	1.35	
1 - 1-1/4-inch nipple, 2-1/2-inches long, galv.	.07	
1 - 1-1/4-inch union, galv.	.44	
Total for one	$ 2.38	
Eight required - total for the eight		$ 19.04

Special riser for center of field

1 pc. 1-1/4-inch pipe, 2 feet long, galv.	$ .26	
1 - 1-1/4-inch tee, galv.	.19	
1 - 1-1/4-inch nipple, 2-1/2 inches long, galv.	.07	
1 - 1-1/4-inch gate valve, brass	1.35	
1 - 1-1/4-inch nipple, 2-1/2 inches long, galv.	.07	
1 - 1-1/4-inch union, galv.	.44	
1 - 1-1/4-inch nipple, 2-1/2 inches long, galv.	.07	
1 - 1-1/4-inch gate valve, brass	1.35	
1 - 1-1/4-inch nipple, 2-1/2-inches long, galv.	.07	
1 - 1-1/4-inch union, galv.	.44	
Total	$ 4.31	
Only one required - total cost		$ 4.31

Main Pipe Line

9 - 1-1/4-inch tees, galv.	$ 1.71	
525 feet - 1-1/4-inch pipe, galv.	70.88	
1 - 1-1/4-inch plug, galv.	.06	
Total for main pipe line	$72.65	$72.65

Pumping Plant and Suction System

2 - 1-1/2-inch elbows, 45°, galv.	$ .56	
30 ft. 1-1/2-inch pipe, galv.	4.84	
6 - extra threads, with pipe cut to suit	.54	
1 - gasoline engine-driven displacement pumping unit to deliver 17 g.p.m. against a total dynamic head liable to vary between 80 and 120 feet	$175.00	
1 - 1-1/4-inch nipple, 2-1/2-inches long, galv.	.07	
1 - 1-1/4-inch union, galv.	.44	
1 - 1-1/4-inch nipple, 6 inches long, galv.	.12	
1 - 1-1/4 x 1 x 1-1/4 inch tee, galv.	.19	

1 - 1-inch by 3/4-inch bushing, galv.	$ .08	
1 - 3/4-inch nipple 3 inches long, galv.	.04	
1 - 1-3/4-inch faucet or hose bibb, brass	.69	
1 - 1-1/4-inch nipple 6 inches long, galv.	.12	
1 - 1-1/4-inch union, galv.	.44	
1 pc. 1-1/4-inch pipe 12 inches long, galv.	.28	
1 - 1-1/4-inch elbow, 90°, galv.	.19	
Total	$183.60	
		$183.60

Incidentals

Foundation (concrete) for pumping unit		
Bolts for fastening unit to foundation		
Concrete foundation for unit		
Chocking blocks for nozzle line wheels		
Screen box or suitable screen		
Estimated total	$40.00	
		$ 40.00
Grand total		$436.66

A special drilling and tapping machine for drilling the nozzle holes must be borrowed, rented, or bought. If purchased it will cost approximately $25. The above estimate assumes that enough pipe-fitting tools are available, in addition to the tools ordinarily found on farms, to assemble the outfit; if not such tools will add about $20 to the expense, making a total cost for 2 acres of $481.66 or a little over $240 per acre.

If three-phase, 60-cycle, 220 or 440-volt electricity is available for the tract under consideration, somewhat cheaper irrigation could be obtained by increasing the size of the main pipe and using a suitable electrically-driven, 2-stage, close-coupled, centrifugal pumping unit. Such a pump will deliver the necessary water with a 1-horsepower motor if the maximum pumping head can be reduced from 120 feet to 95 feet. This can be done under the conditions previously described by using 1-1/2 inch pipe instead of 1-1/4 inch pipe for the main and making other suitable changes. This will reduce the total dynamic pumping head for the spray irrigation of the tract under discussion to range from 70 to 95 feet, and will make the materials for the whole irrigation plant cost about $375 or about $188 per acre instead of the figures given.

Figure 1 shows the suggested layout for the above equipment. The parts being irrigated with the two portable wheeled devices are indicated by shading. Figure 2 gives an idea of how the portable outfit appears when constructed.

In general, the construction of such an irrigation outfit should follow the construction directions given in U.S. Department of Agriculture Farmers' Bulletin No. 1529 "Spray Irrigation in the Eastern States". Certain details of the portable outfit should be especially noted, however, as proper handling of these features affects the usefulness of the outfit. While other methods of handling the details are possible, the solutions mentioned will serve. Figure 3 shows the method of getting water to the portable nozzle line when irrigating. It shows the assembly of the outlet or hydrant attached to the fixed main pipe, the connecting hose, and the drop pipe leading to the end of the nozzle line. Figure 3 also shows the extension handle on the turning union used to hold the nozzle line in the desired position. Because of the fact that the wheeled supports for the nozzle line do not always line up perfectly, strains are produced in the pipe that tend to make it rotate instead of staying in position when set to spray at the different angles necessary to obtain reasonably uniform distribution over the area to be wetted. A collapsible extension to the handle of the turning union can readily be made by replacing the short handle that comes with the turning union by a longer one of the same size, and slipping over it a larger pipe fixed so that the handle can be extended but cannot slip off. This can be accomplished in the following manner: A 1-inch pipe, having a 1-inch coupling and a 1 by 3/4-inch bushing can be slipped over the 1/2-inch pipe onto which a 1/2-inch cap can afterwards be screwed to prevent the larger pipe from coming off. Both portions of the handle should be as long as possible and still clear the ground when the nozzle pipe is rotated. In operation, the lower end of the extension handle may be shoved into the ground when the nozzles are set to spray at the desired angle. If the turning union comes equipped with a different size or type of handle, some other arrangement may be devised to serve the same purpose.

The wheels may be held in place on the nozzle line by farm-made wooden shaft collars, two of which will be needed for each wheel. The type shown in detail A of figure 3 is simple to make and may readily be clamped fast by drawing up on the bolts. The type shown in detail B is also simple and is clamped fast to the pipe by tightening the bolt that draws up the circumferential band of plumbers perforated strap iron. Detail C shows a type of convenient farm-made chocking block. In a stony field chocking blocks will not be necessary. Oftentimes, however, when rolled to a new position the supporting wheels will roll away unless some means are at hand to hold them in position. Blocks as shown, equipped with hooks of heavy wire so that they may be hung from the nozzle pipe when the outfit is being moved, will be found useful in such instances.

The tract to be irrigated must be near a water supply. In the example for which the bill of materials was prepared the edge of the field was taken as 100 feet from the water supply. A lake or stream was considered, but a free yielding well with the water surface within easy suction lift of the ground surface when being pumped would do as well. A long, narrow tract of land leading directly away from the water supply is favorable to inexpensive irrigation of this type if the water supply is a lake or stream; if a well is used a long, narrow tract leading both ways from the well situated near its center is most favorable. The land should be level, gently sloping, or only slightly rolling since this type of irrigation is not well adapted to steep land.

The soil should be such as will not get too soft or too sticky when wet, otherwise the wheeled spray line will be hard to roll from the area just irrigated to the next setup. It is possible that wheels with extra wide tires might roll over soils that get soft, but not sticky, as a result of the watering. This type of irrigation is probably not adapted to use on sticky cultivated soils. The system herein described is not adapted to the irrigation of crops that reach a height of more than about 22 inches or half the height of the supporting wheels. Such crops as strawberries, lettuce, spinach, beets, carrots, and string beans may be grown on a field irrigated with such equipment.

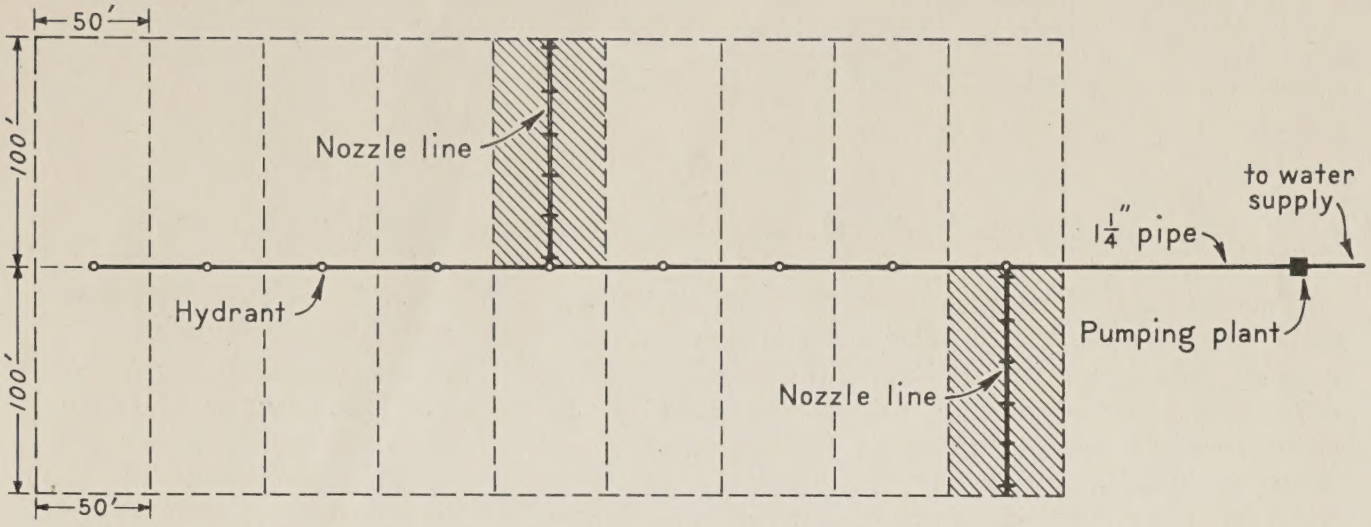

Fig. 1

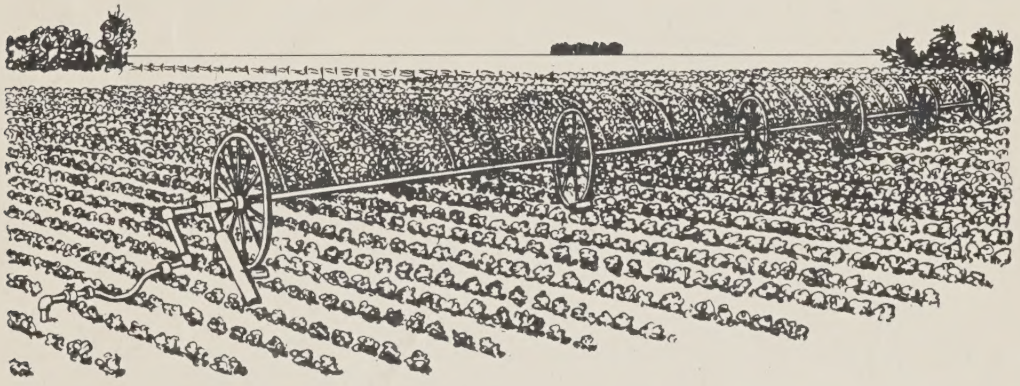

Fig. 2

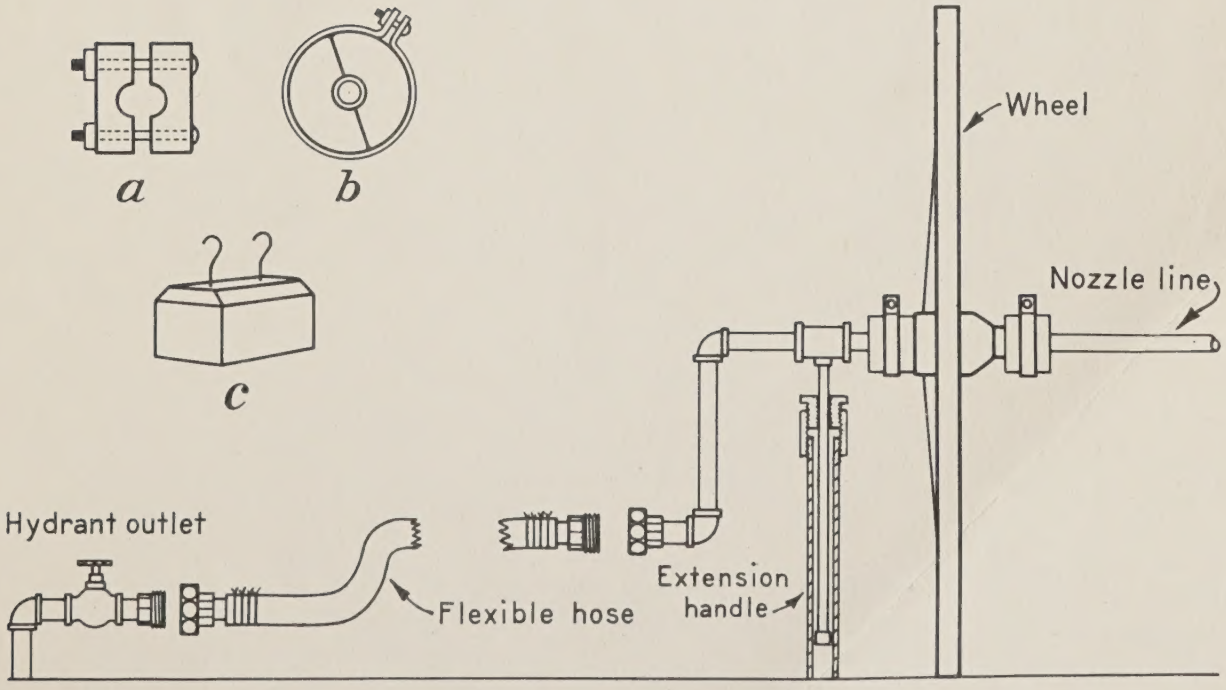

Fig. 3